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Helminth Fauna of Bats in Japan XIX*

With 14 Text-figures

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ABSTRACT Two new hymenolepidid cestodes, *Vampirolepis fujiensis* and *Rodentolepis hattorii*, parasitic to the horseshoe bat, *Rhinolophus ferrumequinum*, are described from Yamanashi Prefecture and Hokkaido. At the same time, four hymenolepidid cestodes were isolated from the common cave bats, *R. cornutus*, *R. c. perditus*, *R. ferrumequinum*, *R. f. mikadoi*, *Miniopterus schreibersii* and *M. s. blepotis*, collected in the Prefectures of Okinawa, Ōita, Yamaguchi, Yamanashi and Yamagata, and Hokkaido.

Cestodes parasitizing the cave bats in Okinawa and Hokkaido have not previously been examined. During the period from February to November, 1977, the present studies were carried out to clarify the systematic position of cestodes parasitic on bats in Okinawa and Hokkaido, and in such other localities as Ōita, Yamaguchi, Yamanashi and Yamagata Prefectures.

The data on the bats examined and cestodes recovered are seen in Table 1, and the collecting sites of the bats are shown on the map (Fig. 1).

Most bats were captured alive and were autopsied immediately to recover living cestodes from the small intestine. Scolexes and mature eggs were examined in physiologic saline solution. Some of the cestodes were fixed in AFA and stained with Heidenhain's haematoxylin. Measurements are given in millimeters.

The cestodes recovered from bats represent the following species: *Vampirolepis isensis* Sawada, 1966, *V. hidaensis* Sawada, 1967, *V. ogaensis* Sawada, 1974, *V. fujiensis* n. sp., *Hymenolepis rashomonensis* Sawada, 1972, and *Rodentolepis hattorii* n. sp.

Vampirolepis Spassky, 1954

Vampirolepis hidaensis Sawada, 1967

Medium-sized hymenolepidid. The cestodes containing mature eggs recovered

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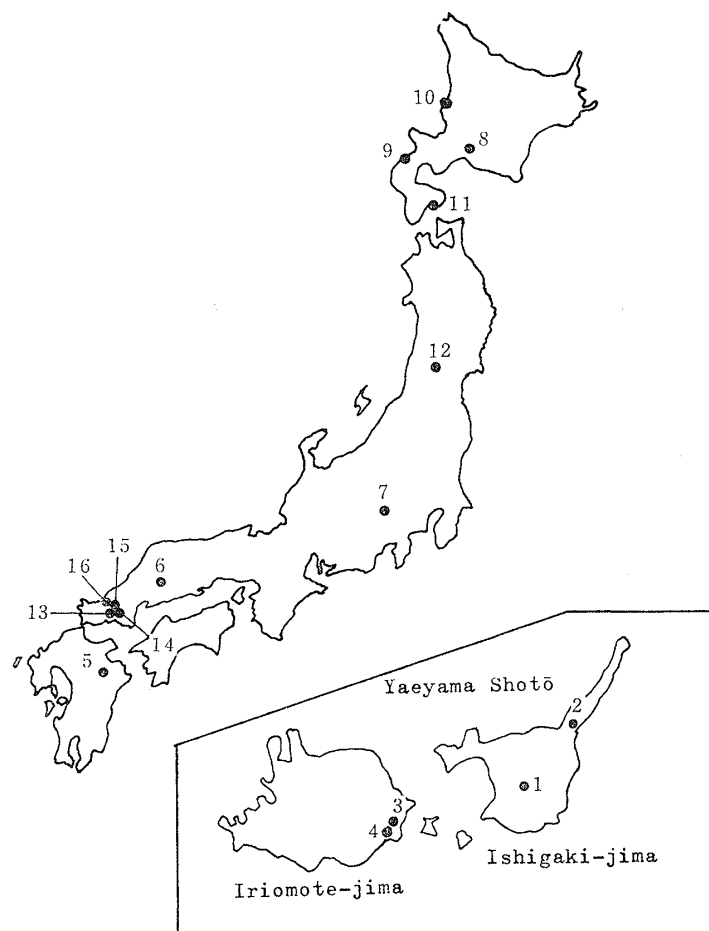


Fig. 1. Sketch map showing the collecting sites of the bats examined from which cestodes were recovered.

during the active and inactive periods of the bats are 86 to 97 in length and 1.9 to 2.4 in maximum width. Scolex 0.318 to 0.346 long and 0.346 to 0.553 broad. Rostellum 0.138 by 0.083; distal end armed with a single row of 24 to 26 hooks, each measuring 0.018 to 0.021 long; rostellar sac, prominent, 0.290 by 0.150. Sucker discoid, 0.111 to 0.138 in diameter. Genital pores unilateral, situated middle of proglottid margin. Cirrus pouch, 0.168 by 0.049. Both internal and external seminal vesicles are present. Testes arranged in a transverse row. Ovary oval, situated near center of proglottid. Egg 0.035 to 0.039 by 0.024; onchosphere 0.021 to 0.028 by 0.023 and embryonic hook 0.014 in length.

Host. *Miniopterus schreibersii*, *M. s. blepotis*.

For locality, see Table 1 and Fig. 1.

***Vampirolepis isensis* Sawada, 1966**

Medium-sized hymenolepidid. Specimens found during the inactive period of the bat were comparatively small (Ôtomi-daini-dô Cave, Iriomote Island).

Table 1
Summary of cestodes found in bats collected during the period from February to November, 1977.

Serial No. of localities in Fig. 1	Caves	Locations	Dates	Bat species	Number of bats			Cestode species
					examined	infected	%	
1	Daiichi-fukubuku-izaa	Ishigaki-jima, Okinawa Pref.	22-II	<i>Miniopterus schreibersii blepotis</i>	10	5	50	<i>V. hidaensis</i>
2	Inoda-izaa	" "	23-II	" "	6	3	50	" "
3	Ôtomi-daiichi-dô	Iriomote-jima, Okinawa Pref.	"	<i>Hipposideros turpis</i>	11	0	0	" "
4	Ôtomi-daini-dô	" "	24-II	<i>M. s. blepotis</i>	10	3	30	<i>V. hidaensis</i>
"	"	" "	"	<i>Rhinolophus cornutus perditus</i>	4	4	100	<i>V. isensis</i>
5	Kômorî-ana	Ume-machi, Ôita Pref.	17-III	<i>M. schreibersii</i>	5	1	20	<i>V. hidaensis</i>
"	"	" "	"	<i>R. ferrumequinum</i>	5	5	100	<i>H. rashomonensis</i>
6	Oni-no-iwaya	Tôjô-chô, Hiroshima Pref.	28-V	<i>M. schreibersii</i>	2	1	50	<i>V. hidaensis</i>
7	Gan-no-ana	Fujiyoshida-shi, Yamanashi Pref.	22-VII	<i>R. ferrumequinum mikadoi</i>	5	1	20	<i>V. fujienensis</i> n. sp. <i>H. rashomonensis</i>
8	Rangoshi water tunnel	Chitose-shi, Hokkaido	25-VIII	<i>Myotis macro- dactylus</i>	10	0	0	" "
9	Katanakake-dôkutsu	Iwanai-chô, Hokkaido	26-VIII	<i>R. ferrumequinum</i>	2	2	100	Larvae (species name unknown)
"	"	" "	"	<i>R. cornutus</i>	8	0	0	" "
10	Yoshitsune-dôkutsu	Mashike-chô, Hokkaido	27-VIII	<i>R. ferrumequinum</i>	6	5	83	<i>H. rashomonensis</i> <i>Rodentolepis hattorii</i> n. sp.
11	Anamaiwa-dôkutsu	Hakodate-shi, Hokkaido	29-VIII	"	1	1	100	<i>V. ogaensis</i>
12	Autigua of silver mine	Obanazawa-shi, Yamagata Pref.	4-X	"	5	4	80	<i>H. rashomonensis</i> <i>V. ogaensis</i> <i>V. isensis</i>
"	"	" "	"	<i>R. cornutus</i>	8	3	38	" "
13	Akiyoshi-dô	Shuhô-chô, Yamaguchi Pref.	19-XI	<i>M. schreibersii</i>	8	2	25	<i>V. hidaensis</i>
14	Kômorî-ana	" "	"	<i>R. cornutus</i>	7	1	14	<i>V. isensis</i>
15	Terayama-no-ana	" "	"	<i>R. ferrumequinum</i>	9	0	0	" "
16	Kannon-dô	Fukue-son, Yamaguchi Pref.	20-XI	" "	8	0	0	" "

Worm length 26 to 32; greatest width 0.7 to 0.9. Scolex 0.280 by 0.287. Sucker oval, 0.091 by 0.105. Rostellum 0.161 by 0.070, armed with a single row of 24 hooks, each measuring 0.032 to 0.035 long.

Host. *Rhinolophus cornutus perditus*, *R. cornutus*.

For locality, see Table 1 and Fig. 1.

Vampirolepis ogaensis Sawada, 1974

Medium-sized hymenolepidid. Strobila length 40 to 47; maximum width 0.5 to 0.7. Scolex 0.259 to 0.301 by 0.175 to 0.210; rostellum 0.056 to 0.084 by 0.119 to 0.133; armed with a single row of about 30 hooks, 0.021 long. Sucker oval, 0.084 to 0.098 in diameter. Egg spherical, 0.042 by 0.046, surrounded by 4 envelopes, the outermost one of which is slightly thick and has rough surface. Onchosphere spherical, 0.025 in diameter; embryonic hook about 0.014 long.

Host. *Rhinolophus ferrumequinum*.

For locality, see Table 1 and Fig. 1.

Vampirolepis fujimensis n. sp.

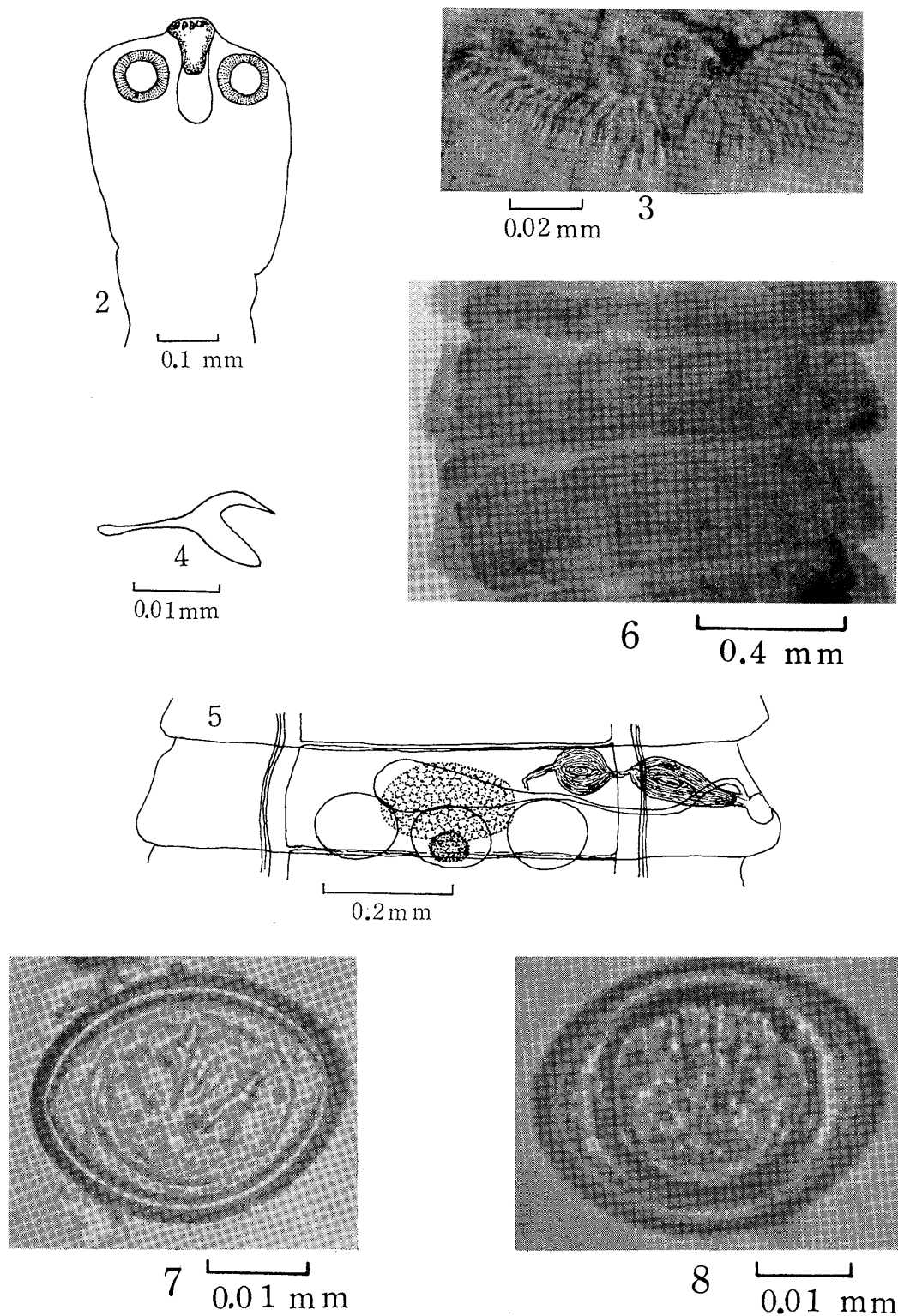
(Figs. 2-8)

Medium-sized hymenolepidid; mature strobila, consisting of about 290 proglottids, are 27 to 39 in length and 1.5 to 1.7 in maximal width. The edges of the proglottids are serrate, the genital pores unilateral, and located at middle of the proglottid margin. The scolex is 0.315 to 0.350 in length and 0.253 to 0.260 in width. The rostellum, measuring 0.063 to 0.083 long and 0.070 to 0.091 wide, is armed with about 28 hooks, 0.018 long, which are arranged in a single row; the blade of hook is curved, shorter than the handle; the guard is prominent.

The rostellum is retractable into a rostellar sac, 0.098 long and 0.070 to 0.077 wide. The unarmed four suckers are rounded, 0.098 to 0.119 in diameter. The slightly tapering neck region behind the scolex is 0.98 to 1.12 long and 0.14 to 0.21 wide. The testes are 3 in number, 0.112 to 0.210 by 0.105 to 0.126, situated in the posterior field of the proglottid and arranged in a transverse row.

The genital atrium is prominent, measuring 0.07 to 0.084 by 0.042 to 0.049. The cirrus sac extends to the longitudinal excretory canal, its size being 0.202 to 0.375 by 0.111. Both the internal and external vesicles are present, measuring 0.111 to 0.277 by 0.111 and 0.138 by 0.152. The compact, elongated ovary is centrally placed, measuring 0.318 to 0.401 by 0.166 to 0.249. The vitelline gland is found at middle field, posterior to ovary, overlapping central testis, and measuring 0.049 to 0.070 in diameter.

The vagina opens into the genital atrium behind the cirrus sac, forming a bulky seminal receptacle at the middle field of the proglottid, and measuring 0.207 by 0.083. In the mature proglottid, the uterus fills the entire medullary parenchyme; it is saccular and divided into many compartments. The eggs are oval, 0.042 by 0.035, surrounded by four envelopes; the outermost chorion is fairly thick and has



Figs. 2-8. *Vampirolepis fujiensis* n. sp. — 2. Scolex. — 3-4. Rostellar hook. — 5. Mature proglottid. — 6. Senile proglottids. — 7. Egg. — 8. Superficial phase of egg shell.

rough surface, but the rest is thin. The onchospheres are spherical, 0.021 to 0.025 in diameter, and embryonic hooks are 0.014 long.

Host. *Rhinolophus ferrumequinum mikadoi*.

Habitat. Small intestine.

Locality and date. Gan-no-ana Caves, Fujiyoshida-shi, Yamanashi Prefecture; July 22, 1977.

Type depository. Biological Laboratory, Nara University of Education, Nara.

Discussion. The nearest relative of the present species is *Vampirolepis hidaensis* Sawada, 1967. The following points are proposed for the differentiation of *V. fujiensis* n. sp. from *V. hidaensis*.

1) Strobila shorter in size; in *V. hidaensis* 60 to 92 in length, but in *V. fujiensis* 27 to 39.

2) Rostellar sac smaller in size; in *V. hidaensis* 0.138 to 0.166 long and 0.084 wide, but in *V. fujiensis* 0.098 long and 0.07 to 0.077 wide.

3) Genital atrium prominent; in *V. hidaensis*, it is smaller and indistinct, but in *V. fujiensis*, it measures 0.07 to 0.084 by 0.042 to 0.049.

4) Chorion rough on the surface; in *hidaensis*, it is smooth.

These characters are sufficient to justify the recognition of a new species, for which the name *Vampirolepis fujiensis* n. sp. is proposed.

Hymenolepis Weindand, 1858

Hymenolepis rashomonensis Sawada, 1972

Small-sized hymenolepidid. Worm length 16 to 32, greatest width 0.4 to 0.5. Scolex 0.238 to 0.245 broad, 0.210 long. Rostellum rudimentary or absent. Sucker 0.098 to 0.112 in diameter. Genital pore unilateral or alternate irregularly, located at the anterior to middle part of proglottid margin. Egg 0.049 to 0.056 by 0.045 to 0.053; onchosphere 0.039 to 0.042; embryonic hook 0.014 in length.

Host. *Rhinolophus ferrumequinum*.

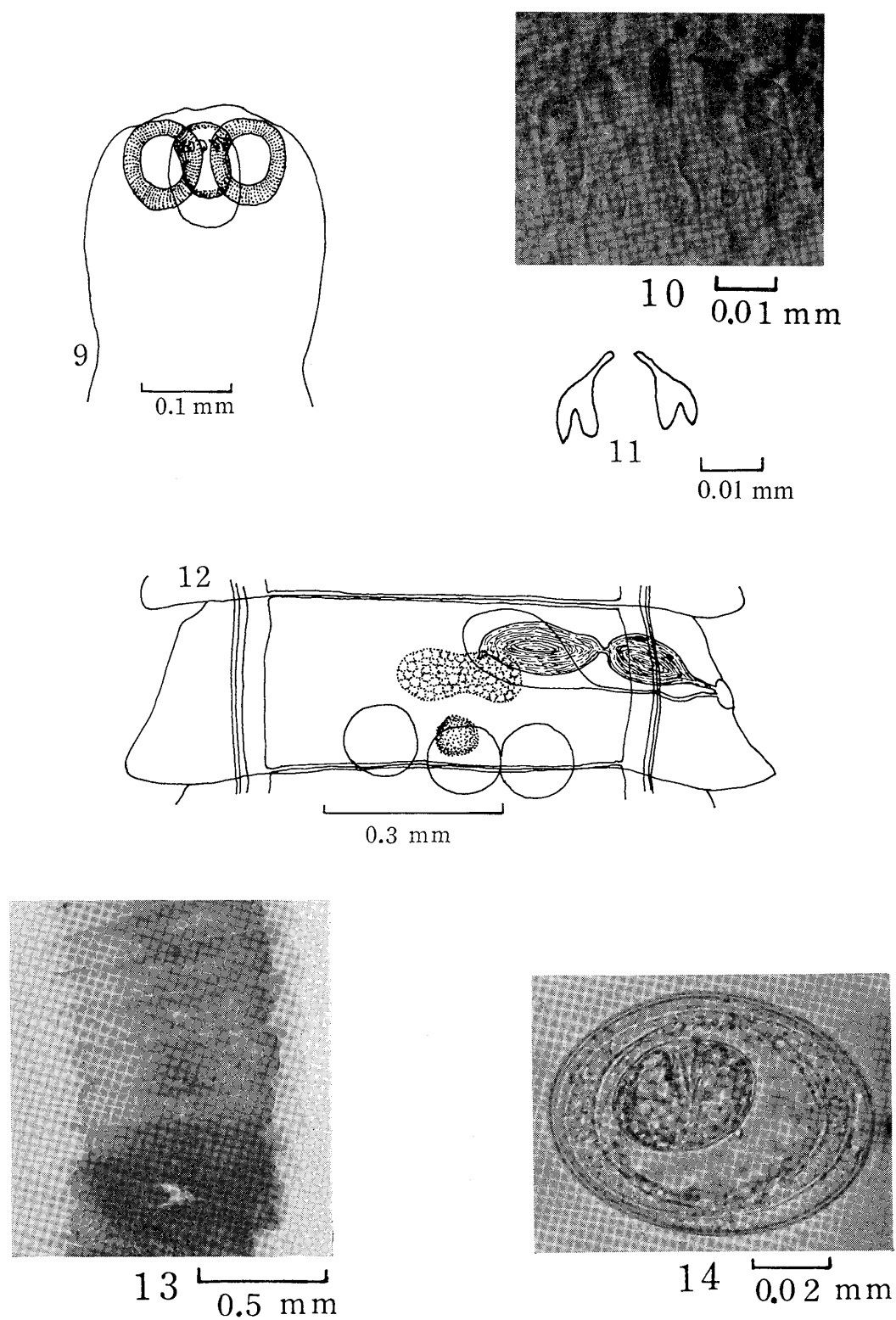
For locality, see Table 1 and Fig. 1.

Rodentolepis Spassky, 1954

Rodentolepis hattorii n. sp.

(Figs. 9–14)

Five strobilas measure 55 to 67 in length and maximum breadth 0.5 to 1.4 in the region of gravid proglottids. Scolex globose, 0.245 to 0.280 long and 0.280 wide. Rostellum introverted in all specimens, 0.070 long and 0.049 wide, with a row of 10 wrench-shaped small hooks, 0.0175 in length; handle of hook comparatively short, guard broad, nearly as long as blade. Rostellar sac 0.105 by 0.077 to 0.091. Suckers rounded, shallow, 0.091 to 0.105 in diameter. Scolex narrows to a short unsegmented neck, 0.25 to 0.29 in diameter. Numerous immature proglottids, much broader than long. Proglottids protandrous, testes developing first followed



Figs. 9-14. *Rodentolepis hattorii* n. sp. — 9. Scolex. — 10-11. Rostellar hooks. — 12. Mature proglottid. — 13. Senile proglottids. — 14. Egg.

by cirrus pouch and female genital organs. Mature, gravid and senile proglottids much broader than long and last senile proglottid measures 0.4 by 1.9. Genital pores unilateral and located at middle or a little anterior to it. Genital atrium comparatively small, 0.021 by 0.035. Ventral longitudinal excretory canal 0.014 in diameter. Testes 3 in number, rounded, 0.063 to 0.070 in diameter, situated in the posterior field of proglottid and arranged in a transverse row or in triangular, one poral and two aporal. In early mature proglottids testes measure 0.028 to 0.035 in diameter. Cirrus pouch measures 0.07 by 0.035. External seminal vesicle, 0.070 to 0.077 by 0.035; internal seminal vesicle 0.042 to 0.056 by 0.028 to 0.035, occupying almost whole of cirrus pouch. Cirrus small, unarmed. Ovary measures 0.105 to 0.126 by 0.049 to 0.063, located in middle of proglottid. Vitelline gland lies just posterior to ovary. Saccate seminal receptacle prominent in mature proglottids, attaining the maximum size of 0.042 by 0.056. Uterus arises directly from ovarian lobes as a lobed sac, but soon extends dorsally and beyond the longitudinal excretory canals, occupying almost whole the proglottid. Numerous eggs are present in the uterus. Chorion smooth and oval, measuring 0.077 to 0.081 by 0.053 to 0.060. Extra-embryonic blastoderm smooth and separated from chorion. Embryonic envelope oval. Onchosphere oval or rounded, 0.025 to 0.028 by 0.021 to 0.025; embryonic hooks 0.018 in length.

The present new species is named in honor of Dr. Hattori, Hokkaido Institute of Public Health, whose advice made the author's collecting of valuable host materials in Hokkaido possible.

Host. *Rhinolophus ferrumequinum*.

Habitat. Small intestine.

Locality and date. Yoshitsune-dôkutsu Cave, Mashike-chô, Hokkaido; August

Table 2
Closely related species armed with 10 rostellar hooks.

Species	Rostellum		Host
	Diameter	Hook length	
<i>R. hattorii</i> n.sp.	0.049	0.0175	<i>Rhinolophus ferrumequinum</i>
<i>R. avetijanae</i>		0.033	<i>Myocastor corpus</i>
<i>R. bahli</i>	0.047-0.05	0.018	<i>Crocidura caerulea</i>
<i>R. blarinae</i>	0.190	0.033	<i>Blarina brevicauda</i>
<i>R. evaginate</i>	0.180	0.020-0.022	<i>Ondatra zibethica</i> , <i>Microtus pennsylvanicus</i>
<i>R. jacobsoni</i>	0.048	0.021	<i>Crocidura murina</i>
<i>R. johnsoni</i>	0.048	0.015	<i>Microtus pennsylvanicus drummondii</i>
<i>R. lineola</i>	0.035	0.0308-0.0324	<i>Sorex fumeus</i>
<i>R. oregonensis</i>	0.255-0.357	0.042-0.048	<i>Ondatra zibethica occipitalis</i>
<i>R. parva</i>	0.130	0.034-0.040	<i>Sorex</i> spp.
<i>R. pearsei</i>		0.069	<i>Hybomys univittatus</i>
<i>R. petrodromi</i>	0.038-0.054	0.028-0.032	<i>Petrodromus tetradactylus</i>
<i>R. virilis</i>	0.063	0.032	<i>Sorex trowbridgei</i>

27, 1977.

Type depository. Biological Laboratory, Nara University of Education, Nara.

Discussion. So far as is known to the author, there are about 32 described species of the genus *Rodentolepis* Spassky, 1954. Of these, only two, *Rodentolepis taruiensis* Sawada, 1967, and *R. macrotesticulatus* Sawada, 1970, have been described from Chiroptera. These species are armed with 23 and 26 to 28 hooks, respectively. The present species is armed with 10 hooks. Twelve of the 32 species belonging to *Rodentolepis* are armed with 10 rostellar hooks (Table 2). The present species closely resembles *R. bahli* Singh, 1948, from *Crocidura caerulea* and *R. johnsoni* Schillar, 1952, from *Microtus pennsylvanicus drummondii*. However, it differs from *R. bahli* in the shape of rostellar hook and the smaller embryonic hooks (0.016), and from *R. johnsoni* in the shape and the length of rostellar hooks (0.015). In *R. bahli*, the handle of rostellar hook is smaller, the blade is well developed and is longer than the guard. On the other hand, in *R. johnsoni*, the handle of the rostellar hook is shorter, and the blade is well developed. The guard is longer and rounded at the top.

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